

TAXONOMY OF THE GENUS *DISSODACTYLUS* (CRUSTACEA: BRACHYURA: PINNOTHERIDAE) WITH DESCRIPTIONS OF THREE NEW SPECIES

Hugh Griffith

ABSTRACT

Several taxonomic problems within the genus *Dissodactylus* (Crustacea: Pinnotheridae) are resolved. *Dissodactylus alcocki* Rathbun, 1918 is a junior synonym of *D. juvenilis* Bouvier, 1917. *D. meyerabichi* Bott, 1955 is a junior synonym of *D. nitidus* Smith, 1870. *D. smithi* Rioja, 1944 is a junior synonym of *D. lockingtoni* Glassell, 1935 and not of *D. nitidus*, as previously described. Three new species, *D. latus*, *D. schmitti* and *D. ususfructus*, are described, and *D. stebbingi* is redescribed, accompanied by a description of the first zoeal stage. Thirteen species are currently recognized, and host and distributional data are given for each. A key to the species of *Dissodactylus* is provided.

Crabs of the genus *Dissodactylus* (Brachyura: Pinnotheridae: Pinnotherinae) are ectosymbiotic on irregular echinoids. Morphological characters supporting the monophyly of the genus include bifid dactyls of the ambulatory legs and fused first and second and third through sixth male abdominal segments.

Dissodactylus was erected by Smith (1870) by monotypy for the species *D. nitidus*. Schmitt et al. (1973) listed 14 species of *Dissodactylus*: *D. alcocki* Rathbun, 1918; *D. borradailei* Rathbun, 1918; *D. calmani* Rathbun, 1918; *D. crinitichelis* Moreira, 1901; *D. glasselli* Rioja, 1944; *D. juvenilis* Bouvier, 1917; *D. lockingtoni* Glassell, 1935; *D. mellitae* (Rathbun, 1900); *D. meyerabichi* Bott, 1955; *D. nitidus* Smith, 1870; *D. primitivus* Bouvier, 1917; *D. rugatus* Bouvier, 1917; *D. stebbingi* Rathbun, 1918 and *D. xantusi* Glassell, 1936. The number of species has since been reduced to 12. Telford (1978a) found *D. borradailei* to be a junior synonym of *D. primitivus*, and Pohle (1984) found *D. calmani* to be a junior synonym of *D. rugatus*.

In the present study, three additional synonyms are recognized and three new species are described. An annotated list of species is given, which includes distributional and host data. Finally, a key to the genus is provided.

MATERIALS AND METHODS

Most of the specimens used in this study were from the collection of Professor Malcolm Telford, Department of Zoology, University of Toronto. These had been collected from echinoid hosts by snorkelling or scuba diving in various locations (Table 1). Other specimens were borrowed from or examined at a number of institutions (Table 2).

Those crabs collected in the field were fixed in 5% formalin mixed with seawater. Most were later stored in 70% ethanol in distilled water. Several *D. stebbingi* females were ovigerous when collected, and these were placed live in separate containers of seawater. Larvae hatched en route between Florida and Toronto, but due to the lack of facilities for rearing larvae, only the first zoeal stage was obtained. Zoeae were fixed in 3% glutaraldehyde mixed in seawater for 24 h, and transferred to 2.5% formalin mixed in seawater.

Adult specimens of all species were compared with types (when available) and with original descriptions and figures. Host and distributional data were collected from published sources and private collections.

Crabs and larvae were examined under compound and binocular dissecting microscopes. Drawings were done using a camera lucida, and measurements were taken with eyepiece micrometers. For crab stages, carapace length was measured as the length at the midline, and carapace width was measured at the widest point.

Table 1. *Dissodactylus* collection localities (C.r. = *Clypeaster rosaceus*; C.s. = *Clypeaster subdepressus*; E.m. = *Encope michelini*; E. spp. = *Encope* spp.; L.s. = *Leodia sexiesperforata*; M.q. = *Mellita quinquesperforata*; M.v. = *Meoma ventricosa*; P.g. = *Plagiobrissus grandis*)

Species	Location	Host	Date
<i>D. crinitichelis</i>	Barbados	L.s.	1974–1978
<i>D. lockingtoni</i>	Puerto Peñasco, Mexico	E. spp.	1980
<i>D. mellitae</i>	Beaufort, N.C.	M.q.	1984
<i>D. nitidus</i>	Puerto Peñasco, Mexico	E. spp.	1980
<i>D. primitivus</i>	Barbados	M.v., P.g.	1974–1978
<i>D. rugatus</i>	Jamaica, Florida Keys	C.r.	1983, 1984
<i>D. stebbingi</i>	Florida Keys	C.s.	1984
<i>D. xantusi</i>	Puerto Peñasco, Mexico	E. spp.	1980
<i>D. latus</i>	Florida Keys	C.s., E.m., L.s.	1982, 1984

Host data have never been provided for *D. alcocki*, *D. juvenilis*, *D. schmitti* and *D. ususfructus*. Probable hosts for these species were determined by examining reports of the echinoderms collected on research cruises during which specimens of the above species had been collected. *Dissodactylus* station data were compared with echinoid station data. Irregular echinoids collected at the same stations as *Dissodactylus* specimens were considered as potential hosts. In addition, the USNM specimens of *D. alcocki*, *D. schmitti* and *D. ususfructus* and the MCZ specimen of *D. juvenilis* were X-rayed at 35 kV for 0.75 min against Kodak RS film. Radiographs were examined under a compound microscope to detect spines, tube-foot spicules or other host tissues. X-ray images of spines were compared with cleaned spines of dried clypeasteroid specimens.

RESULTS AND DISCUSSION

Synonymy of Dissodactylus alcocki Rathbun, 1918 with *D. juvenilis* Bouvier, 1917.—Bouvier (1917) described *D. juvenilis* from two female specimens dredged north of the Yucatan Peninsula on the BLAKE Expedition. These specimens were designated as syntypes for the species. One is in the Museum National d'Histoire Naturelle, Paris (Schmitt et al., 1973). The other is in the Museum of Comparative Zoology and has catalogue number MCZ 9156. The description was re-published by Milne-Edwards and Bouvier (1923) with the addition of figures. The figures showed *D. juvenilis* to have an oblique ridge extending inward from the antero-lateral angle of the carapace, and the palp of the outer maxilliped to be absent. Rathbun (1918) described *D. alcocki* from two incomplete specimens dredged at the ALBATROSS station 2388, Gulf of Mexico, off the Mississippi delta. Her figure showed the palp of the outer maxilliped to be present, and she stated that there was no oblique dorsal ridge on the carapace.

Lemaitre (1984) redescribed *D. juvenilis* Bouvier, 1917, using the MCZ syntype and a male and female collected from Nicholas Channel, Cay Sal Bank, Bahamas. Lemaitre corrected erroneous observations of Bouvier (1917) and Milne-Edwards and Bouvier (1923): the outer maxilliped does have a palp, and there are no oblique dorsal ridges on the carapace. Lemaitre remarked that the absence of dorsal ridges sets *D. juvenilis* apart from other *Dissodactylus* species, apparently unaware that this condition was also described for *D. alcocki* by Rathbun (1918).

A comparison of MCZ 9156 with the holotype of *D. alcocki* (USNM 23447) showed no significant differences. The diagnostic characteristics given by Rathbun (1918) and Lemaitre (1984) apply to all specimens of *D. alcocki* and *D. juvenilis*. Therefore it is concluded that *D. alcocki* Rathbun, 1918 is a junior synonym of *D. juvenilis* Bouvier, 1917.

REMARKS. This is the third of the four new species described by Rathbun (1918) found to be synonymous with one of the three *Dissodactylus* species described by

Table 2. *Dissodactylus* material examined from institutions*

Institution	Species	Identification	No. specimens
AHF	<i>D. glasselli</i>	uncatalogued	1
AHF	<i>D. nitidus</i>	uncatalogued	1
AHF	<i>D. nitidus</i>	uncatalogued	6
AHF	<i>D. nitidus</i>	uncatalogued	7
AHF	<i>D. nitidus</i>	uncatalogued	6
MCZ	<i>D. juvenilis</i> Syntype	MCZ 9156	1
ROM	<i>D. latus</i> Paratypes	ROMIZ L3510	8
SDNHM	<i>D. lockingtoni</i> Holotype	SDNHM 3892	1
SMF	<i>D. glasselli</i>	SMF 2109a	1
SMF	<i>D. meyerabichi</i> Holotype	SMF 2108	1
SMF	<i>D. nitidus</i>	SMF 2109	2
SMF	<i>D. nitidus</i>	SMF 2109a	3
SMF	<i>D. nitidus</i>	SMF 2121	1
USNM	<i>D. alcocki</i> Syntypes	USNM 23447	2
USNM	<i>D. alcocki</i>	USNM 74866	7
USNM	<i>D. alcocki</i>	USNM 74867	6
USNM	<i>D. borradailei</i> Holotype	USNM 49230	1
USNM	<i>D. calmani</i> Holotype	USNM 49233	1
USNM	<i>D. crinitichelis</i>	USNM 23422	1
USNM	<i>D. crinitichelis</i>	USNM 23433	1
USNM	<i>D. crinitichelis</i>	uncatalogued	20+
USNM	<i>D. encopei</i> Syntypes	USNM 23430	20+
USNM	<i>D. latus</i> Holotype	USNM 228029	1
USNM	<i>D. latus</i> Paratype	USNM 228030	1
USNM	<i>D. lockingtoni</i>	acc. no. 207834	30+
USNM	<i>D. lockingtoni</i> Paratypes	USNM 71339	15+
USNM	<i>D. mellitae</i> Syntypes	USNM 23434	20+
USNM	<i>D. nitidus</i>	acc. no. 207834	20+
USNM	<i>D. nitidus</i> Neotype	USNM 216967	1
USNM	<i>D. schmitti</i> Holotype	USNM 216966	1
USNM	<i>D. stebbingi</i> Holotype	USNM 49232	1
USNM	<i>D. stebbingi</i>	acc. no. 95600	2
USNM	<i>D. ususfructus</i> Holotype	USNM 216968	1
USNM	<i>D. ususfructus</i>	USNM 228031	4
USNM	<i>D. xantusi</i> Paratypes	USNM 71546	2
USNM	<i>D. xantusi</i>	acc. no. 207834	10

* Institutional abbreviations used are: AHF, Allan Hancock Foundation, Los Angeles, California; MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts; ROM, Royal Ontario Museum, Toronto, Ontario, Canada; SDNHM, San Diego Natural History Museum, San Diego, California; SMF, Naturmuseum und Forschungsinstitut Senckenberg, Frankfurt a. Main, Federal Republic of Germany; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Bouvier (1917). *Dissodactylus borradailei* Rathbun, 1918 is a junior synonym of *D. primitivus* Bouvier, 1917 (Telford, 1978a), and *D. calmani* Rathbun, 1918 is a junior synonym of *D. rugatus* Bouvier, 1917 (Pohle, 1984).

POSSIBLE HOSTS. Echinoids collected at the same station as the type material of *D. juvenilis* (BLAKE Expedition 1877–1878, Station 36) are listed as *Clypeaster subdepressus* (Gray) (Clypeasteroida), *Agassizia excentrica* A. Agassiz and *Meoma ventricosa* (Lamarck) (Spatangoida) (Agassiz, 1878). *Agassizia excentrica* is a very small species, usually less than 2 cm long, so it is not considered a potential host for *D. juvenilis*. Echinoids collected at the same station as the type specimens of *D. alcocki* (ALBATROSS, March 1885, Station 2388) were *C. subdepressus* and *C. ravenelii* A. Agassiz (Rathbun, 1885). Comparable records are not available for other collections of *D. juvenilis*. Radiographs of USNM 74867 and MCZ 9156 revealed fragments of clypeasteroid spines, most likely *Clypeaster*, in two specimens (Fig. 1). This suggests that *Clypeaster* is one taxon serving as a host for *D. juvenilis*.

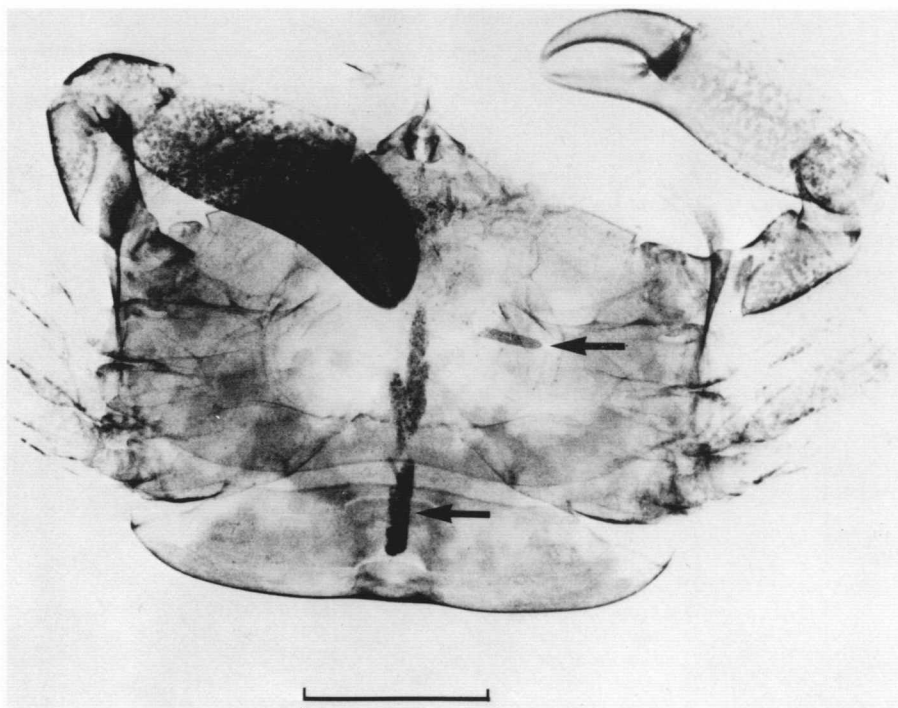


Figure 1. Positive from radiograph of *D. juvenilis*, showing fragments of clypeasteroid spines (arrows) in the digestive tract. Scale bar: 3 mm.

Synonymy of *Dissodactylus meyerabichi* Bott, 1955 with *D. nitidus* Smith 1870.—*D. nitidus* (Fig. 2) was described by Smith (1870). Figures were not provided, and as it was the first *Dissodactylus* species described, comparative diagnostic features were not given. *Dissodactylus nitidus* has subsequently been redescribed and figured (Rathbun, 1910; 1918), although these descriptions were not based on type material. Diagnostic features include a relatively narrow carapace (width to length ratio about 1.1 to 1.2), a slightly protruding front, a wide sternum with a protruding first sternite and a dense tuft of setae at the base of the immobile cheliped finger (Fig. 2A–C). Bott (1955) described the new species *D. meyerabichi*. The holotype is located in the Naturmuseum und Forschungsinstitut Senckenberg (SMF 2108). A photograph of this specimen was provided (Bott, 1955: fig. 13a, b). Examination of the holotype showed all characters to be in agreement with the description of *D. nitidus* by Smith (1870) and with the specimens labeled *D. nitidus* in the USNM collection and those described and figured by Rathbun (1910; 1918). Therefore, *D. meyerabichi* Bott is a junior synonym of *D. nitidus*.

REMARKS. *D. meyerabichi* type material could not be directly compared with Smith's type of *D. nitidus*, because the latter is apparently lost (W. Hartman, Peabody Museum of Yale University, pers. comm.). Thus I designate a male specimen from an uncatalogued lot in the U.S. National Museum collection (accession number 207834) as a neotype (catalogue number 216967). It is noteworthy that the type locality of *D. meyerabichi* (Puerto El Triunfo, El Salvador) falls within the previously described range of *D. nitidus*: Santa Maria Bay, Baja California to Bay of Sechura, west of Mata Caballa, Peru (Rathbun, 1918).

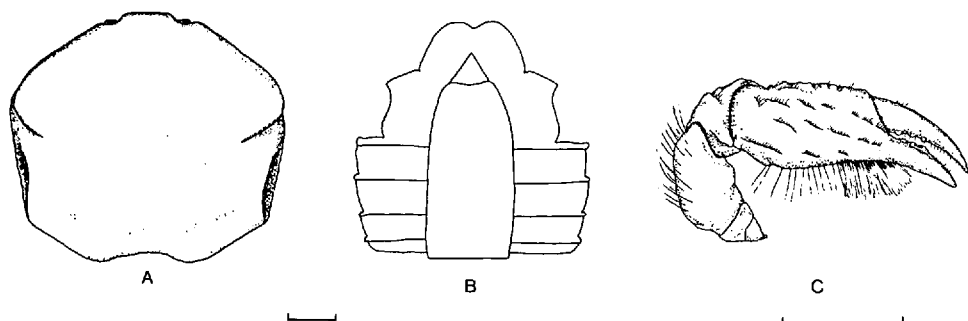


Figure 2. *D. nitidus*. A, dorsal view of carapace; B, sternum and male abdomen; C, ventrolateral view of cheliped. Scale bars: 1 mm.

Synonymy of Dissodactylus smithi Rioja, 1944 with *D. lockingtoni* Glassell, 1935. — Glassell (1935) described the new species *D. lockingtoni*. Rioja (1944) created the new species *D. smithi*, which he compared with Glassell's (1935) description of *D. lockingtoni*, but not with the holotype of that species. Rioja (1944) differentiated between *D. smithi* and *D. lockingtoni* on the basis of shape and bifurcation of the dactyl of the fourth ambulatory leg. He found the dactyl to be bifurcate in *D. smithi*, and following Glassell (1935), he believed the fourth dactyl in *D. lockingtoni* to lack bifurcation. Examination of the holotype of *D. lockingtoni* (SDNHM 3892) shows that the dactyl of the fourth ambulatory leg is slightly bifurcate, however, as in all other *Dissodactylus* species. All other characters used by Rioja (1944) to describe *D. smithi* apply to *D. lockingtoni*, so that no significant differences remain. Thus *D. smithi* Rioja, 1944 is a junior synonym of *D. lockingtoni* Glassell, 1935.

REMARKS. Schmitt et al. (1973) did not list *D. smithi* except as a junior synonym of *D. nitidus*, which had been suggested by Bott (1955). Bott (1955) synonymized *D. smithi* with specimens of a species he believed was *D. nitidus*, collected at Puerto El Triunfo, El Salvador (SMF 2109, 2 females; SMF 2109a, 2 females; SMF 2121, 1 female). Photographs of one of the specimens from SMF 2109 were given (Bott, 1955: plate 8, fig. 12a, b). A comparison of the specimens in Bott's figure 12, and the other specimens in lots SMF 2109, SMF 2109a and SMF 2121 with the holotype of *D. lockingtoni* (SDNHM 3892) showed that Bott's specimens are not *D. nitidus*, but rather *D. lockingtoni*. Thus Bott's *D. nitidus* is an incorrect identification. Bott recognized that *D. smithi* Rioja was conspecific with the specimens in hand and therefore synonymized *D. smithi* with *D. nitidus*, instead of *D. lockingtoni*, in accordance with his erroneous identification.

SUMMARY. In 1944 Rioja described *D. smithi*, which is a junior synonym of *D. lockingtoni* Glassell, 1935. Bott (1955) incorrectly concluded that *D. smithi* was a junior synonym of *D. nitidus* Smith, because he had identified specimens of *D. lockingtoni* as *D. nitidus*. He named *D. meyerabichi*, which is a junior synonym of *D. nitidus* Smith.

Dissodactylus ususfructus new species

Figure 3

Type locality. — S-SE Judas Pt., Costa Rica. 80–120 m.

Diagnosis. — Carapace slightly domed in center, width to length ratio of adults approximately 1.30–1.40. Lateral margin continuous, sharp-edged. Shallow groove

extending mesially and very slightly posteriorly onto dorsal carapace surface from anterolateral angle for about $\frac{1}{3}$ carapace width. Center of first sternite extends beneath buccal region, with shallow medial notch. Palp of outer maxilliped very narrow, 3-segmented, third segment minute. Ambulatory legs with few setae, dorsal margins sharp-edged.

CARAPACE (3A, B). Shiny and smooth. Widest at anterolateral angles, lateral margin concave posteriorly. Convex longitudinally, slightly so transversely. Slightly domed in gastric region, shallow groove or gutter proximal to all margins on dorsal surface. Anterolateral margin continuous with posterolateral margin, sharp edged. Front a little convex or straight. Pterygostomium concave. Ventral margins fringed with short, plumose setae.

STERNUM (3C). Broad between cheliped coxae. Central region of first sternite extends forward beneath buccal cavity, slight medial notch.

OUTER MAXILLIPED (3D). Ischium and merus fused, suboval, distally pointed. Palp with three very narrow segments, extends from distal end of merus. Palpal segments attached end to end, first and second segments subequal in length, third (dactyl) much shorter.

CHELIPEDS (3E). Merus smooth on dorsal surface, distal margin fringed by short plumose setae. Carpus with pointed distomedial process. Distal margin serrated, with small plumose setae between serrae. Outer surface of propodus roughened by short, oblique rows of minute setae. Inner surface smooth. Dorsal margin almost straight, ventral sinuous. Dactyl gently tapered, deflexed, tip rounded. Occlusal margins of fingers toothless, sharp. Tips cross when closed, dactyl inside propodus.

AMBULATORY LEGS (3F, G). Relatively long and slender, dorsal margins sharp-edged. Merus with a few long slender setae ventrally, minute setae distally on merus, carpus, propodus. Carpus widest subterminally, constricted proximal to articulation with propodus. Margins of propodus subparallel, distally slightly tapered. Dactyls very narrow, slightly curved, pointed, bifurcate less than $\frac{1}{4}$ length.

MALE ABDOMEN (3C). First and second segments fused, lateral margins slightly concave. Third to sixth segments fused, lateral margins straight. Seventh segment subtriangular, distal half more tapered than proximal half. Tip rounded. First male pleopod (gonopod) short, shaft almost straight, tip short, narrow, laterally bent (3H).

FEMALE ABDOMEN (3I). All seven segments separate. First less than $\frac{1}{2}$ length of second. Second widening gradually, margins of third and fourth almost parallel. Fifth and sixth narrowing gradually. Seventh subtriangular, approximately $\frac{1}{2}$ width of sixth, fitting in slight depression in sixth.

Material Examined.—Two males, three females (one immature) found among *Dissodactylus* collection of USNM, catalogue number 216968. Labels in vial indicate that these specimens were collected by the New York Zoological Society, ZACA Expedition, 1937–38. A male specimen from this lot is hereby designated as the holotype for *D. ususfructus* and retains USNM catalogue number 216968. The four paratypes remain in the collection of the USNM and have been given catalogue number 228031.

Measurements.—For five specimens with carapace lengths between 3.4 and 4.9 mm, width to length ratios ranged from 1.18 (smallest specimen) to 1.38, with a mean of 1.32 ± 0.08 .

Remarks.—This species apparently was named by Dr. S. A. Glassell, sometime during the 1930's. It is assumed that he prepared a manuscript, complete with figures (copies of which are on file in the USNM pinnotherid picture file), which was never published. The specimens Glassell used for his figures have Allan Hancock Foundation collection numbers 209-34, 944-39, and USNM accession

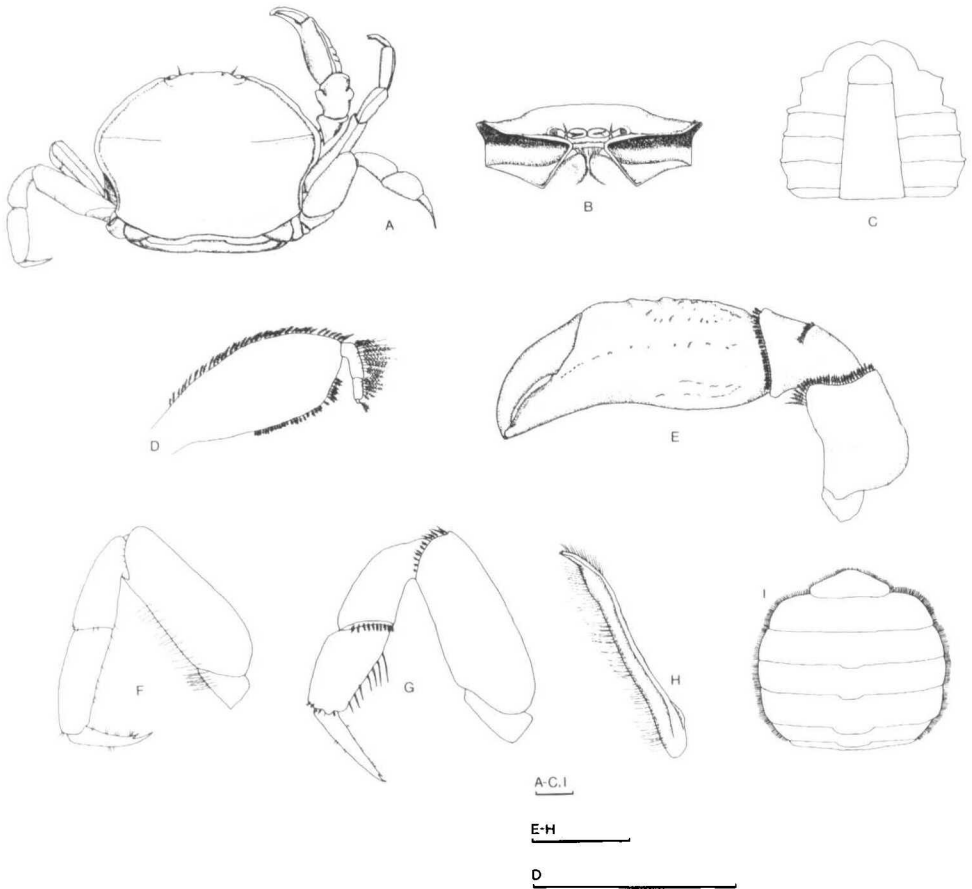


Figure 3. *D. ususfructus*, Holotype. A, dorsal view, left cheliped, first and fourth ambulatory legs absent, and right first and third ambulatory legs absent; B, anterior view of carapace; C, sternum and male abdomen (segments 3-7), D, endopodite of outer maxilliped; E, lateral view of left cheliped; F, third ambulatory leg; G, fourth ambulatory leg; H, gonopod; I, female abdomen. Scale bars: 1 mm.

numbers 128938 and 152360 respectively. Localities for these two specimens are "off Santa Elena Bay, Ecuador, 20°08'20"S, 81°00'15"W, and 10 miles southwest of Secas Islands, Panama, 7°51'10"N, 82°12'05"W" (Fraser, 1943).

Hosts for this species are unknown, although a label in the jar containing the five specimens from the ZACA expedition says "Pinnotherids from sand dollars . . . Sta. 214 D-3, 4." The echinoderm collection record of the ZACA expedition of 1937-38 (Clark, 1940) shows that *Chlypeaster europacificus* was collected at station 214 D-1. It is possible that this is the host of *D. ususfructus*. Radiographs of the five USNM specimens showed no identifiable gut contents.

Rathbun (1918) noted that the outer maxillipeds of the *Dissodactylus* species known at that time fell into two distinct forms, one with a suboblong ischio-merus and large palp, the other with an oval ischio-merus and very small palp. The maxillipeds of *D. ususfructus* are of the latter form. This is the first known Pacific species to show this condition; hence both "large-palped" and "small-palped" species now are known from the Atlantic and Pacific oceans (Table 3).

Table 3. Atlantic and Pacific *Dissodactylus* species with "large-palped" and "small-palped" outer maxillipeds

Maxilliped	Atlantic species	Pacific species
Large-palped	<i>D. crinitichelis</i>	<i>D. glasselli</i>
	<i>D. latus</i>	<i>D. lockingtoni</i>
	<i>D. mellitae</i>	<i>D. nitidus</i>
	<i>D. primitivus</i>	<i>D. schmitti</i>
Small-palped		<i>D. xantusi</i>
	<i>D. juvenilis</i>	<i>D. ususfructus</i>
	<i>D. stebbingi</i>	
	<i>D. rugatus</i>	

Etymology. — The specific name was provided by Glassell, and is a Latinized legal term meaning "having the right to use and enjoy the fruits or profits of another." Presumably Glassell possessed data which demonstrated the parasitic habit of this species. If so, the name is appropriate, so I chose to retain it.

Dissodactylus schmitti new species

Figure 4

Type Locality. — Five miles north of White Friars, Pacific Coast of Mexico, 17°31'N, 101°29'W.

Diagnosis. — Carapace convex longitudinally, transversely almost flat between anterolateral angles, more convex posteriorly. Width to length ratio about 1.35. Branchial region slightly inflated posterior to anterolateral angle. Lateral margin disjunct at anterolateral angle, anterior portion extending as a low ridge obliquely onto carapace surface for about 1/5 carapace width. First sternite with ovate lateral lobes separated from central region by deep notches, medial notch absent. Palp of outer maxilliped robust, 3-segmented, dactyl about 1/4 length of propodus. Margins of ambulatory legs lined with palisades of long, simple setae.

Description of Female. — CARAPACE (4A). Smooth, convex longitudinally, somewhat convex transversely posterior to anterolateral angles. Branchial region slightly inflated. Margin anterior to anterolateral angle roughened, not distinct. Ridge lining anterolateral margin extending onto dorsal surface obliquely for a short distance. Anterior margin convex, posterior margin sinuous. Buccal area a rounded triangle, epistome short, curved downward at ends. Front not protruding. Eyes small, not visible from above.

STERNUM (4B). First segment with large, rounded lateral lobes, separated from medial lobe by deep notches. Anterior margin of medial lobe rounded, no medial notch.

OUTER MAXILLIPED (4C). Ischium and merus fused, proximal half narrow with subparallel margins, distal half wider, subrectangular. Palp large, extending to anterior margin of sternum, consisting of three segments. Small dactyl emerging from distal inner corner of propodus.

CHELIPEDS. Dorsal surface of merus with many long, fine setae. Carpus with broken line of short setae extending inward from lateral angle. Propodus relatively slender, with three setose ridges obliquely crossing dorsal margin; greatest depth 1/3 from proximal end. Fingers curve downward and inward, when closed, tip of dactyl fitting inside tip of propodus. Finger tips pointed. Propodal finger with two,

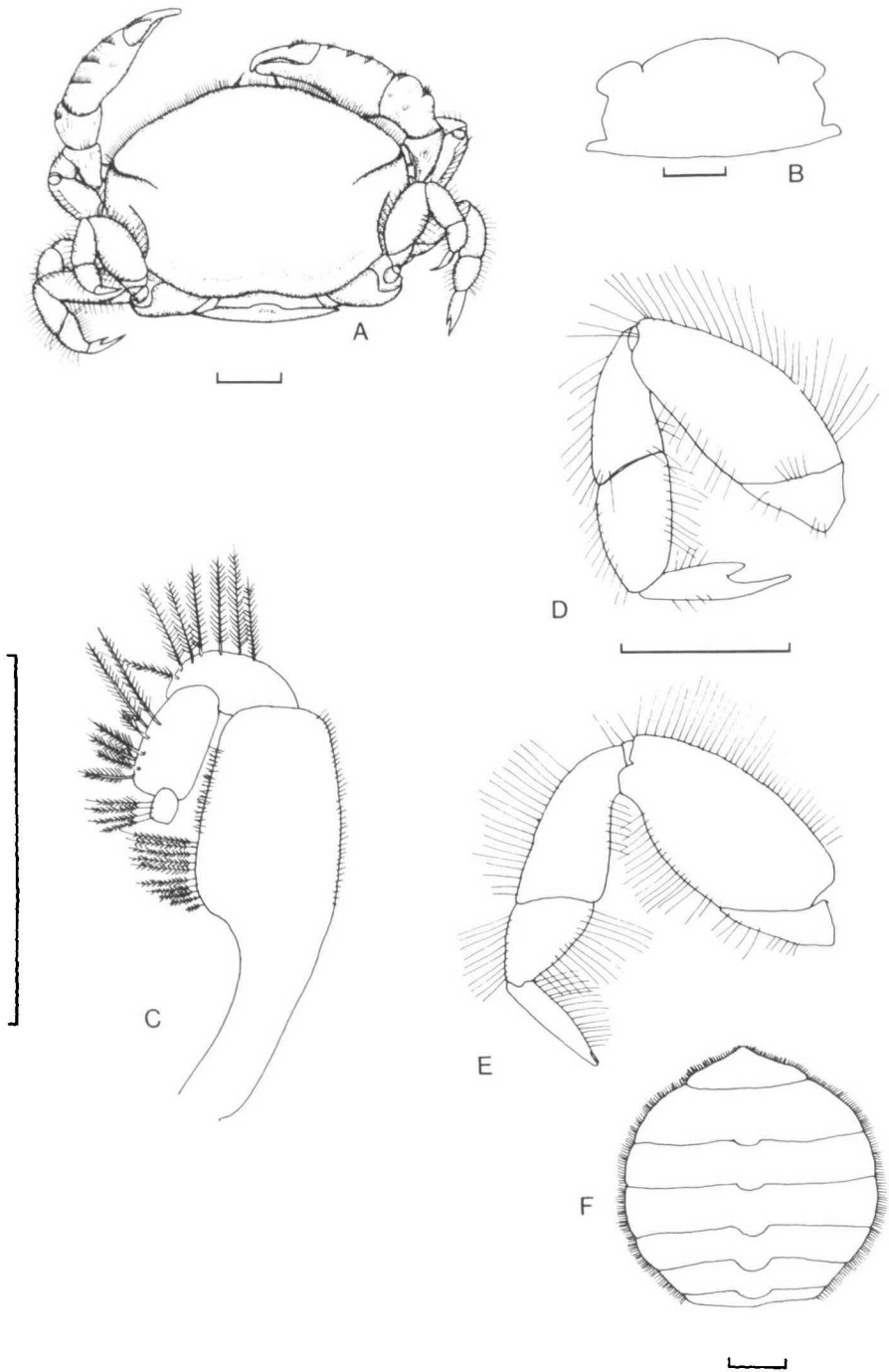


Figure 4. *D. schmitti*, Holotype. A, dorsal view, right second ambulatory leg absent; B, first segment of sternum; C, endopodite of outer maxilliped; D, third ambulatory leg; E, fourth ambulatory leg; F, female abdomen. Scale bars: 1 mm.

small, low-crowned teeth proximally, notch proximal to these receiving posterior tooth of dactyl.

AMBULATORY LEGS (4D, E). Relatively stout, flattened within limb plane. Propodus broad proximally, tapering to dactyl, margins convex. Dorsal and ventral margins of merus, carpus and propodus fringed with long setae. Dactyls longer than propodi. Dactyls 1 to 3 bifurcate between $\frac{1}{3}$ and $\frac{1}{2}$ their length. Secondary spine less than $\frac{1}{2}$ the length of primary spine. Fourth dactyl minutely bifurcate, secondary spine small and appressed against pointed tip.

FEMALE ABDOMEN (4F). All segments separate. First segment narrow and very short, $\frac{1}{3}$ length of second. Second segment widening, margins straight. Third to sixth segments with convex sides, hence abdomen almost circular. Seventh segment triangular, pointed, twice as wide as long, half length of sixth.

Measurements.—Female holotype (USNM 216966), carapace width 5.1 mm, length 3.8 mm.

Remarks.—This species is known from a single specimen in the USNM crustacean collection. The right outer maxilliped has been removed as if for a figure, and there is a manuscript name (no date) attributing it to Glassell. A male specimen also named *D. schmitti* was in the same vial, although it is definitely not conspecific with the female. It appears to be *D. glasselli* Rioja, 1944. It is not known which of the Allan Hancock Foundation station numbers on the label within the vial (764-38, 963-39) belongs to which specimen, although they refer to almost the same locality ("north of White Friars, Mexico") (Fraser, 1943), but from different cruises. The female specimen is designated the holotype of *D. schmitti*, and is given the USNM catalogue number 216966. The host(s) of this species is unknown. In the account of the echinoderms collected on the Allan Hancock Foundation cruises of 1938 and 1939, Clark (1948) did not give station data for all species, and no potential host species was specified as being collected at either of the above stations. Radiographs of the specimen show no identifiable debris in the alimentary tract.

Etymology.—Glassell named this species for the late Dr. Waldo L. Schmitt, eminent carcinologist and former Curator of Crustacea at the USNM.

Dissodactylus latus new species

Figure 5

Type Locality.—Three miles northeast of Pigeon Key, Florida, on *Clypeaster subdepressus* at a depth of 6 m.

Diagnosis.—Carapace rounded longitudinally, almost planar transversely, very wide (width to length ratio 1.6 or greater). Lateral margin discontinuous at anterolateral angle, ridge lining margin continuing obliquely onto dorsal carapace surface for about $\frac{1}{3}$ carapace width. First segment of sternum with distinct notches halfway between the midline and the lateral margins. Palp of outer maxilliped 3-segmented. First two segments robust, third minute, originating from inner distal margin of second. Margins of ambulatory legs lined with palisades of long simple setae.

CARAPACE (5A, B). Smooth and shiny. Convex longitudinally, almost flat transversely. Widest at anterolateral angles, but only slightly wider than at posterolateral angles. Gently ridged anterolateral margin emerging beneath orbits, proceeding onto dorsal surface of carapace posterior to anterolateral angle, extending mesially and posteriorly for a short distance. Ventral margins fringed with plumose setae.

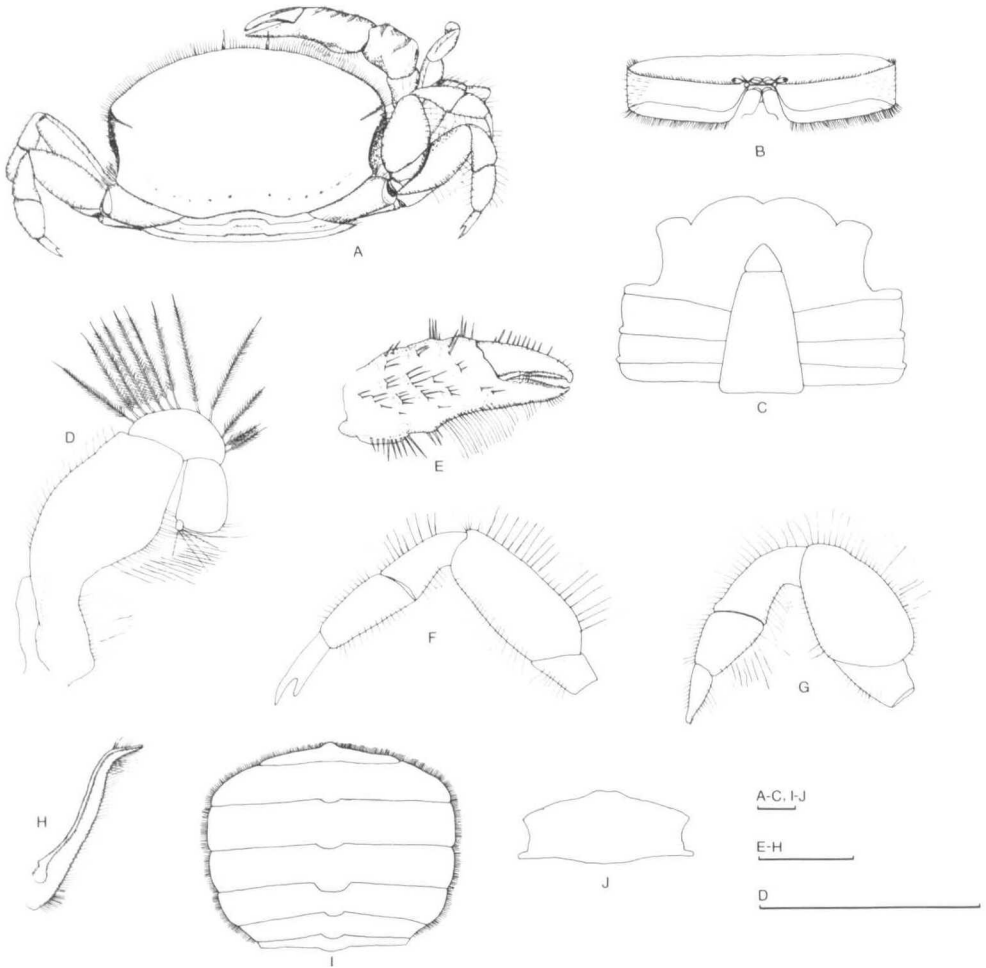


Figure 5. *D. latus*, Holotype. A, dorsal view, left cheliped, and first and second ambulatory legs absent; B, anterior view of carapace; C, sternum and male abdomen (segments 3–7); D, endopodite and exopodite of outer maxilliped; E, medial view of chela of left cheliped; F, third ambulatory leg; G, fourth ambulatory leg; H, gonopod; I, female abdomen; J, first sternite of *D. crinitichelis*. Scale bars: 1 mm.

Front very slightly convex, eyes and antennular fossae very small, distance between orbits less than $\frac{1}{5}$ carapace width, eyes not visible from above.

STERNUM (5C). First segment broad, distinct lateral notches midway between shallow medial notch and lateral margins.

OUTER MAXILLIPED (5D). Ischium and merus fused. Basally narrow, sides parallel, gradually widening until $\frac{1}{3}$ length from distal end, distally subparallel. Lateral margin lined by short plumose setae, tuft of long, fine plumose setae emerging from outer distal margin and extending over palp. Carpus and propodus large, dactyl small, situated on inner distal margin of propodus. Exopodite reduced, no flagellum.

CHELIPEDS (5E). Outer surface of merus with long, fine setae. Carpus with transverse ridge lined with dense row of fine setae. Distal margin fringed with

stiff setae. Propodus long, narrow, slight swelling proximally on the ventral margin. Longitudinal row of plumose setae on inner surface, just above ventral margin. Outer face with oblique ridges accompanied by short setae. Dorsal margin crossed by three transverse, setose ridges. Fingers narrow, moderately pointed, curved downward and inward. Occlusal margins sharp, with lateral grooves bearing rows of very small setae. Occlusal margin of propodal finger with two low teeth proximally. Dactyl with one very small tooth, proximal to propodal teeth. Fingers crossing at tips, dactyl inside propodus.

AMBULATORY LEGS (5F, G). First to third moderately broad, fourth quite stout, especially merus. Longitudinal rows of long setae on dorsal margin and anterior and ventral surfaces of merus and propodus. Dactyls one to three bifurcate for about $\frac{1}{3}$ length. Fourth dactyl not truly bifurcate, but with minute subterminal spine lying against tip.

MALE ABDOMEN (5C). Segments one and two fused, with small notches and a slight constriction at line of fusion. Segments three to six entirely fused, margins convex distally. Seventh segment almost an equilateral triangle, sides slightly convex.

GONOPOD (5H). Reaching to about proximal margin of sixth segment. Widest at base, shaft gently bowed outward, short tip, bent laterally at obtuse angle to shaft. Under LM, tip appears unornamented. Lateral margin of shaft and both margins of tip fringed with setae.

FEMALE ABDOMEN (5I). All segments free. First segment narrow and very short. Second segment more than twice as wide as first, margins divergent and continuous with those of third segment. Fourth to sixth segments of almost equal length, about $\frac{2}{3}$ length of third. Lateral margins of fourth and fifth segments almost parallel. Lateral margins of sixth segment converging gradually, continuing onto seventh. Seventh segment a short, wide triangle with base 5 to 6 times height. Lateral and distal margins of abdomen fringed with short fine setae.

Material Examined.—Ten males and eight females, collected from *Clypeaster subdepressus*, *Encope michelini* and *Leodia sexiesperforata* in the Florida Keys. A female holotype and male paratype have been deposited in the USNM crustacean collection and have been given catalogue numbers 228029 and 228030, respectively. Two female and six male paratypes have been deposited in the Royal Ontario Museum, Toronto, Canada, as a single lot with catalogue number ROMIZ L3510. The remaining paratypes are in the personal collection of Professor Malcolm Telford, Department of Zoology, University of Toronto.

Measurements.—For 18 specimens with carapace lengths ranging from 1.79 to 4.89 mm, width to length ratios ranged from 1.60 (smallest specimen) to 1.73 with a mean of 1.66 ± 0.05 .

Remarks.—Rathbun's (1918) key to the species of *Dissodactylus* fails to distinguish between this species and *D. encopei* which is a junior synonym of *D. crinitichelis*. *D. latus* shares with *D. crinitichelis* a short, oblique dorsal ridge, and dactyls of the first three ambulatory legs, which are bifurcate for less than half their length. Moreira's (1901) figure of *D. crinitichelis* and Rathbun's (1918) figure and plates of *D. encopei* show that *D. crinitichelis* is narrower than the species described here. Rathbun (1918: 121) said of *D. crinitichelis*, "There is some variation in the width of the carapace and legs and in the amount of bifurcation of dactyls." The mean ratio of carapace width to length for twenty specimens of *D. crinitichelis* from an uncatalogued lot in the USNM collection from Villa Bella, São Paulo, Brazil was found to be 1.43 ± 0.03 . Telford (1978a) found the carapace width to length ratio of 90 specimens of *D. crinitichelis* from Barbados to range between

1.41 and 1.50. As mentioned above, the mean of the ratio of carapace width to length for the eighteen *D. latus* specimens examined was 1.66 ± 0.05 .

Another important difference between *D. crinitichelis* and *D. latus* is the anterior margin of the sternum, which has conspicuous notches halfway between the mid-line and lateral margins in *D. latus* (Fig. 5C), and very inconspicuous or completely fused notches in *D. crinitichelis* (Fig. 5J).

Rathbun (1918) gave the range of *D. crinitichelis* as "West coast of Florida to Rio Grande do Sul, Brazil." It is possible that Rathbun and subsequent workers have identified specimens of *D. latus* as *D. crinitichelis* so that the range and host records for the two species have been combined.

Etymology.—The specific name "latus" describes the breadth of the carapace, which is the greatest for any *Dissodactylus* species known.

Dissodactylus stebbingi Rathbun, 1918 redescription

Figure 6

Dissodactylus stebbingi Rathbun, 1918:123, fig. 69; pl. 28, figs. 1, 2.

Type Locality.—Sarasota Bay, Florida.

Holotype.—One ♂, USNM, no. 49232.

Diagnosis.—Carapace slightly rounded longitudinally, almost planar transversely. Lateral margin continuous, transverse, narrow groove extending inward from the anterolateral angle for about $\frac{1}{3}$ carapace width. Anterior margin sharp-edged. Palp of outer maxilliped very narrow, 3-segmented. Terminal segment (dactyl) minute. First sternite with shallow medial notch, central region projecting beneath buccal region. Ambulatory legs broad, margins setose.

CARAPACE (6A, B). Smooth and shiny, transversely almost flat, dorsal surface slopes forward from anterolateral angles. Widest at anterolateral angles. Anterior margin sharp-rimmed, continuous with posterolateral margin. Narrow groove extending inward from in front of anterolateral angle across top of carapace, almost transversely, for about $\frac{1}{3}$ carapace width. Front slightly convex. Eyes relatively large, partially visible from above.

STERNUM (6C). Wide anteriorly. Central region of first sternite extending forward beneath posterior buccal cavity as a simple shelf. Shallow medial notch.

OUTER MAXILLIPED (6D). Ischium and merus fused, distally expanded to form rounded, paddle-like blade. Palp 3-segmented, narrow, third segment (dactyl) minute. Palp not extending beyond distomedial margin of merus. Exopodite reduced, $\frac{1}{2}$ length of ischio-merus; flagellum lacking.

CHELIPEDS (6E). Outer face of merus with long plumose setae. Merus, carpus and propodus with short, transverse rows of short setae. Propodus dorsoventrally wide, widest just proximal to fingers. Dorsal margin slightly convex, ventral margin almost straight. Dorsal margin an ill-defined bumpy ridge. Fingers deflexed, not gaping. Tips acute and overlapping, dactyl inside propodus.

AMBULATORY LEGS (6F, G). Broad and short, sparse long simple setae on dorsal margin and ventrally on anterior and posterior faces of merus, carpus and propodus. First three pairs of dactyls bifurcate less than one third their length. Smaller spine of dactyl less than $\frac{1}{2}$ length of larger spine. Fourth dactyl minutely bifurcate. Margins of dactyls gradually tapering, spines curved. Inner (smaller) spine projecting anterior to plane of dactyl.

MALE ABDOMEN. (6C). First and second segments of almost equal length, fused,

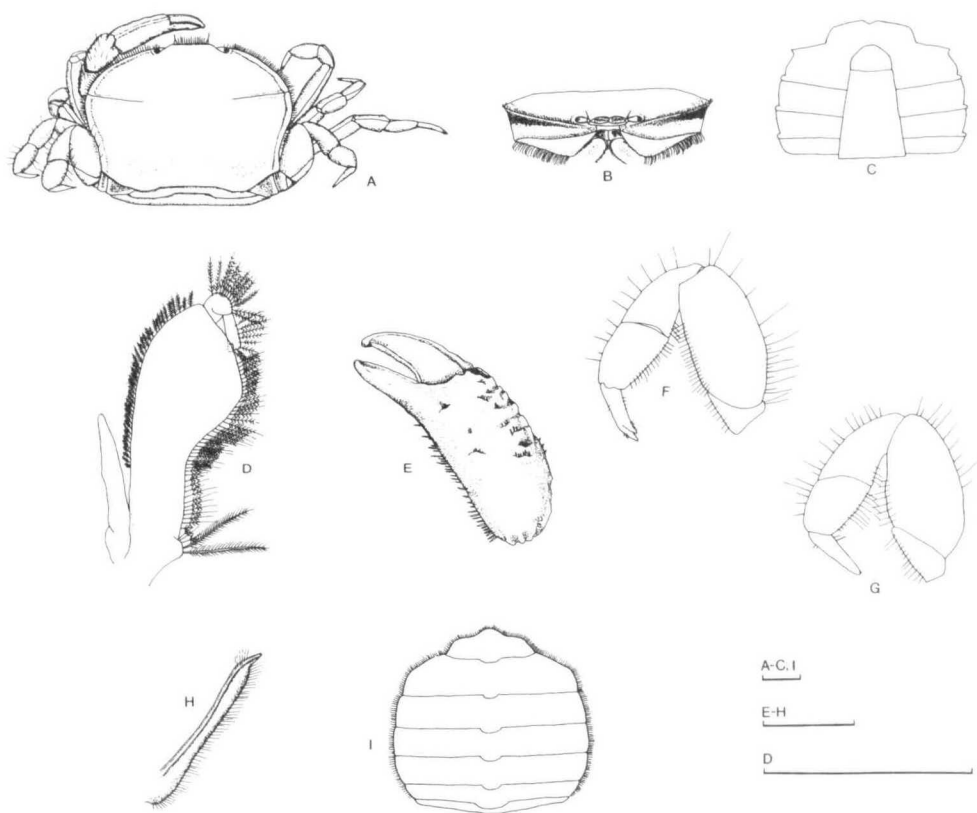


Figure 6. *D. stebbingi*. A, dorsal view, right cheliped absent; B, anterior view of carapace; C, sternum and male abdomen (segments 3-7); D, endopodite and exopodite of outer maxilliped; E, medial view of chela of right cheliped; F, third ambulatory leg; G, fourth ambulatory leg; H, gonopod; I, female abdomen. Scale bars: 1 mm.

sides slightly concave. Third to sixth segments fused, sides straight, gradually convergent. Seventh segment subtriangular, wider than long, sides gradually tapering for proximal $\frac{1}{3}$, tapering more abruptly towards apex. First pleopod short, straight, acuminate (6H).

FEMALE ABDOMEN (6I). First segment half as long as second, second shorter than third. Lateral margins of second and third almost continuous, diverge slightly. Sides of third to sixth segments convex. Seventh segment subtriangular, much wider than long. Abdomen covers most of sternum.

Material Examined.—Four males and four females collected from *Clypeaster subdepressus*, 3 miles south of Pigeon Key, Florida; two uncatalogued USNM specimens (USNM acc. 96500).

Measurements.—For eight specimens ranging in carapace length from 1.42 to 3.86 mm, carapace width to length ratios varied from 1.32 (smallest specimen) to 1.58 (largest specimen) with a mean of 1.44 ± 0.08 .

Remarks.—This species has only been collected from *Clypeaster subdepressus* in the Gulf of Mexico, off southwest Florida.

First Zoeal Stage (Fig. 7).—This description follows the style of Pohle (1984).

CARAPACE (7A). Rostral, dorsal and lateral spines moderately long. Lateral

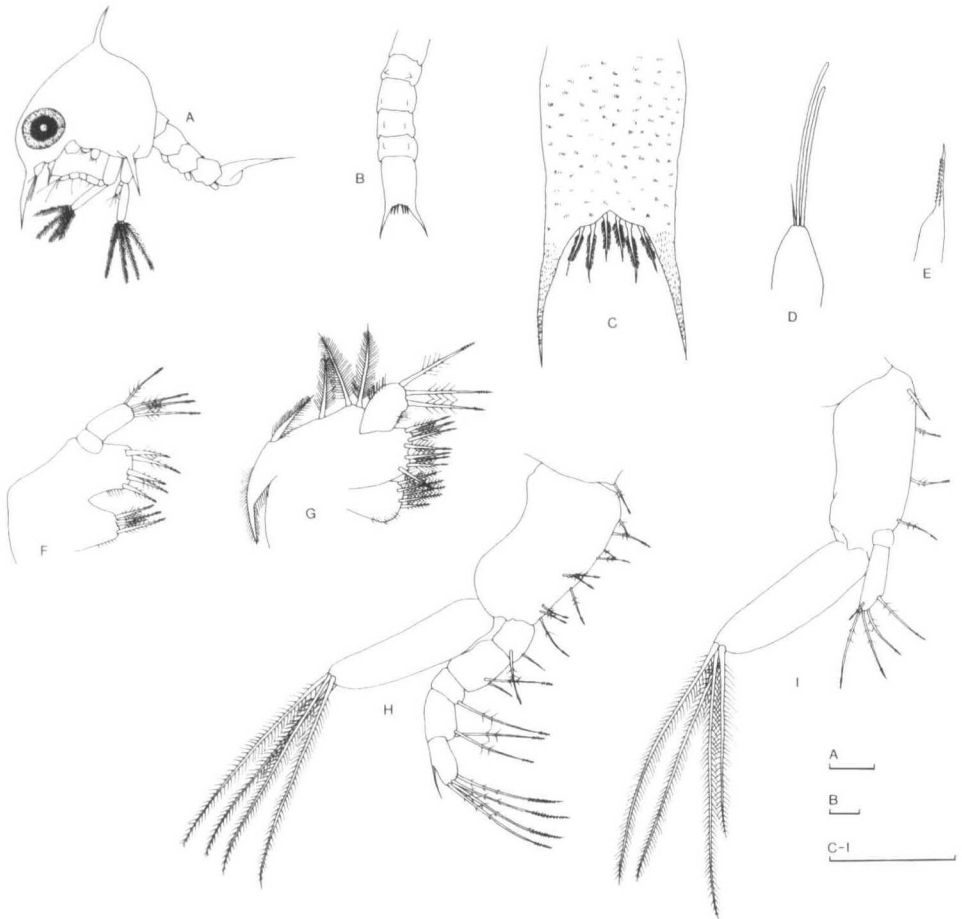


Figure 7. First zoea of *D. stebbingi*. A, lateral view; B, dorsal view of abdomen; C, telson; D, antennule; E, antenna; F, maxillule; G, maxilla; H, first maxilliped; I, second maxilliped. Scale bars: 100 μ m.

spines angled downward slightly. Eyes sessile. Short, simple setae situated on either side of dorsal spine.

ABDOMEN (7B). Five somites and a telson. One pair of distolateral spines found on second somite, none visible on third. Fourth and fifth somites not laterally inflated.

TELSON (7C). Bifurcated, each furca bearing a minute proximal spinule. Furcal shafts densely spinulose except at tips. Furcal arch indistinct, not arcuate, three plumodenticulate setae on either side of midline. Dorsal surface ornamented with patches of denticulettes.

ANTENNULE (7D). Unsegmented, smooth and conical. Terminally, one short, two long aesthetascs.

ANTENNA (7E). Elongate, uniramous, pointed, lacking endopodite. Protopodite tapered, with two rows of spinules, decreasing in size distally.

MANDIBLE. Asymmetrical, with serrated molar region. Palp absent. Two incisor processes.

MAXILLULE (7F). Coxal endite with proximal microtrichia, and four tapered plumodenticulate setae. Basal endite with medial microtrichia, three subterminal

and two terminal plumodenticulate setae. Endopodite two-segmented, four terminal plumodenticulate setae on terminal segment.

MAXILLA (7G). Coxal endite single-lobed, five setae. Basal endite with slight indentation, four setae on each side. Endopodite unsegmented, three terminal plumodenticulate setae. Dense cluster of microtrichia on distolateral corner. Scaphognathite with four marginal plumose setae, fourth directed forward. Tapering terminal process.

FIRST MAXILLIPED (7H). Coxopodite with single small plumodenticulate seta on distal corner. Basipodite with ten plumodenticulate setae arranged in four groups of 2,2,3,3 (proximally to distally). Exopodite with four long, stout, natatory plumose setae. Endopodite with five segments, second longest, third shortest. Single simple setae on first, second and fifth segments; single plumodenticulate on first through third segments, two on fourth; four plumodenticulate terminally on fifth.

SECOND MAXILLIPED (7I). Coxopodite with no setae. Basipodite with four, almost equally spaced plumodenticulate setae. Endopodite with short proximal and longer distal segment. Distal segment with one small subterminal, four terminal plumodenticulate setae. Endopodite with four natatory setae.

THIRD MAXILLIPED. Not discernible.

PEREIOPODS. Undifferentiated, not discernible.

Measurements.—For 20 specimens, mean lengths of rostral, dorsal and lateral spines, respectively, were 0.199 ± 0.015 mm, 0.178 ± 0.016 mm and 0.121 ± 0.013 mm. The mean value for carapace length (base of rostral spine to postero-ventral margin) was 0.396 ± 0.023 mm.

Remarks.—The first zoea of *D. stebbingi* is smaller than the first zoeae of *D. crinitichelis*, *D. primitivus* and *D. rugatus* (Pohle, 1984) in overall carapace length, and in the lengths of all three spine types. There are ten setae on the basipodite of the first maxilliped, and the lateral margins of the fourth and fifth abdominal somites are parallel, as in *D. crinitichelis* and *D. primitivus*. The third abdominal somite lacks dorsolateral spines as in *D. rugatus*, and the arch of the telson is not well formed, though is not reduced as much as in *D. rugatus*.

ANNOTATED LIST OF SPECIES OF *DISSODACTYLUS* SMITH, 1870

D. crinitichelis Moreira, 1901

D. crinitichelis Moreira, 1901: 37, pl. 3, figs. 1–4 (type locality, Estado do Rio Grande do Sul, Brazil).

D. encopei Rathbun, 1901: 22, fig. 5 (type locality, Stann Creek, 38 miles south of Belize, British Honduras).

Range.—Continental shelf off North Carolina (Williams et al., 1968); eight miles south of Alligator Point, Florida (Wass, 1955); Eleuthera, Bahamas (M. Telford, personal collection); Vieques, Porto Rico (Rathbun, 1933); Jamaica (Rathbun, 1918); Barbados (Telford, 1978b; 1982); Stann Creek, 38 miles south of Belize, British Honduras (Rathbun, 1901); Sabanilla, Colombia (Rathbun, 1918); Estado do Rio Grande do Sul, Brazil (Moreira, 1901).

Hosts.—*Encope emarginata* (Leske), *E. michelini* L. Agassiz (Williams et al., 1968); *Clypeaster subdepressus* (Gray) (Wass, 1955); *Leodia sexiesperforata* (Leske) (Telford, 1978b).

Remarks.—As mentioned above, it is possible that the range and host records of this species may include those which should be attributed to *D. latus*.

D. glasselli Rioja, 1944

D. glasselli Rioja, 1944: 150, figs. 7–10, 16–21 (type locality, Playa de San Benito, cerca de Tapachula, Chiapas, Mexico).

Range. — Playa de San Benito, cerca de Tapachula, Chiapas, Mexico (Rioja, 1944); Puerto el Triunfo, El Salvador (see remarks).

Hosts. — *Mellita longifissa* Michelin (Rioja, 1944).

Remarks. — The lot of *D. lockingtoni* (SMF 2109a) collected at Puerto el Triunfo and discussed by Bott (1955) contains a single female specimen of *D. glasselli* (not noted by Bott).

D. juvenilis Bouvier, 1917

D. juvenilis Bouvier, 1917: 397 (type locality, 23°73'N, 89°16'W, north of Yucatan).

D. alcocki Rathbun, 1918: 124, pl. 27, figs. 5–8, text fig. 68 (type locality, Gulf of Mexico, off Delta of Mississippi River, 29°24'30"N, 88°01'00"W).

Range. — Gulf of Mexico, off Delta of Mississippi River (Rathbun, 1918); Nicholas Channel, Cay Sal Bank, Bahamas (Lemaitre, 1984); Tortugas, Florida (Rathbun, 1918).

Hosts. — Suspected to include *Clypeaster subdepressus* (Gray).

D. lockingtoni Glassell, 1935

D. lockingtoni Glassell, 1935: 100, pl. 27, figs. 5–8, text fig. 68 (type locality, Punta Peñasco, Sonora, Mexico).

D. smithi Rioja, 1944: 149, figs. 1–6, 11–15 (type locality, En la playa de San Benito, Chiapas a unos 50 km de Tapachula, Mexico).

Range. — Punta Peñasco, Sonora, Mexico (Glassell, 1935); “San Felipe, Gulf of California, and Punta Peñasco . . . undoubtedly ranges throughout the Gulf of California” (Glassell, 1935: 101).

Hosts. — *Encope californica* Verrill, *E. grandis* L. Agassiz, *E. micropora* L. Agassiz, *Mellita longifissa* Michelin (Glassell, 1935).

D. mellitae (Rathbun, 1900)

Echinophilus mellitae Rathbun, 1900: 590 (type locality, Pensacola, Florida).

D. mellitae Rathbun, 1901: 22.

Range. — Vineyard Sound (Sumner, 1909); Martha's Vineyard, Massachusetts; Narragansett Bay (Rathbun, 1918); Bird Island Shoal, North Carolina (Pearse, 1936); Beaufort, North Carolina (Pearse et al., 1942; Bell and Stancyk, 1983; Bell, 1984); continental shelf off the coast of North Carolina (Williams et al., 1968); Alligator Harbor, Florida (Wass, 1955); Pensacola, Florida (Rathbun, 1900; 1918); Galveston, Texas (Rogers, 1968).

Hosts. — *Echinarachnius parma* (Larmack), *Mellita quinquiesperforata* (Leske) (Rathbun 1901; Telford, 1982; Bell and Stancyk, 1983; Bell, 1984); *Encope michelini* L. Agassiz and *Clypeaster subdepressus* (Gray) (Williams et al., 1968).

D. nitidus Smith, 1870

D. nitidus Smith, 1870: 173 (type locality, Panama).

D. meyerabichi Bott 1955: 61, pl. 8, fig. 13, text fig. 2a–d (type locality, Puerto el Triunfo, El Salvador).

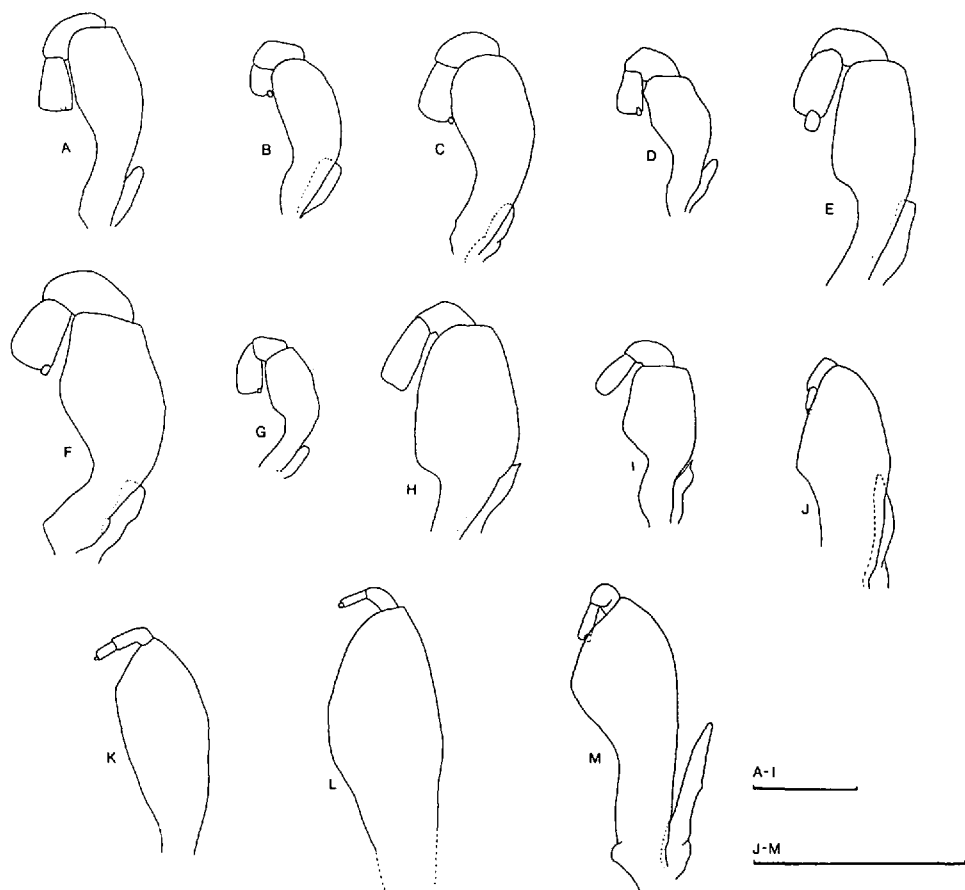


Figure 8. Outer maxillipeds of *Dissodactylus* species. A, *D. nitidus*; B, *D. lockingtoni*; C, *D. xantusi*; D, *D. primitivus*; E, *D. schmitti*; F, *D. latus*; G, *D. crinitichelis*; H, *D. glasselli*; I, *D. mellitae*. J, *D. rugatus*; K, *D. ususfructus*; L, *D. juvenilis*; M, *D. stebbingi*. Scale bars: 1 mm.

Range.—Off Abreojos Pt., Lower California (Rathbun, 1898; 1918); Santa Maria Bay, Baja California (Rathbun, 1923); Concepcion Bay, Lower California (Glassell, 1934; Steinbeck and Ricketts, 1941); Puerto Peñasco, Sonora, Mexico (M. Telford, personal collection); Gulf of California (Lockington, 1877); Puerto Triunfo, El Salvador (Bott, 1955); west of Matacaballa, Bay of Sechura, Peru (Rathbun, 1910).

Hosts.—*Encope californica* Verrill, *E. grandis* L. Agassiz, *E. micropora* L. Agassiz, *Mellita longifissa* Michelin (Glassell, 1935).

D. primitivus Bouvier, 1917

D. primitivus Bouvier, 1917: 394 (type locality, Straits of Florida).

D. borradailei Rathbun, 1918: 121, pl. 27, figs. 5–8, text fig. 68 (type locality, Miami, Florida).

Range.—Straits of Florida (Bouvier, 1917); Miami, Florida (Rathbun, 1918); Hawk Channel, Florida (M. Telford, personal collection); Jamaica (Telford, 1982); Discovery Bay, Rockley Beach, Barbados (Telford, 1978b); San Blas Islands, Panama (from the collection of Dr. H. Lessios).

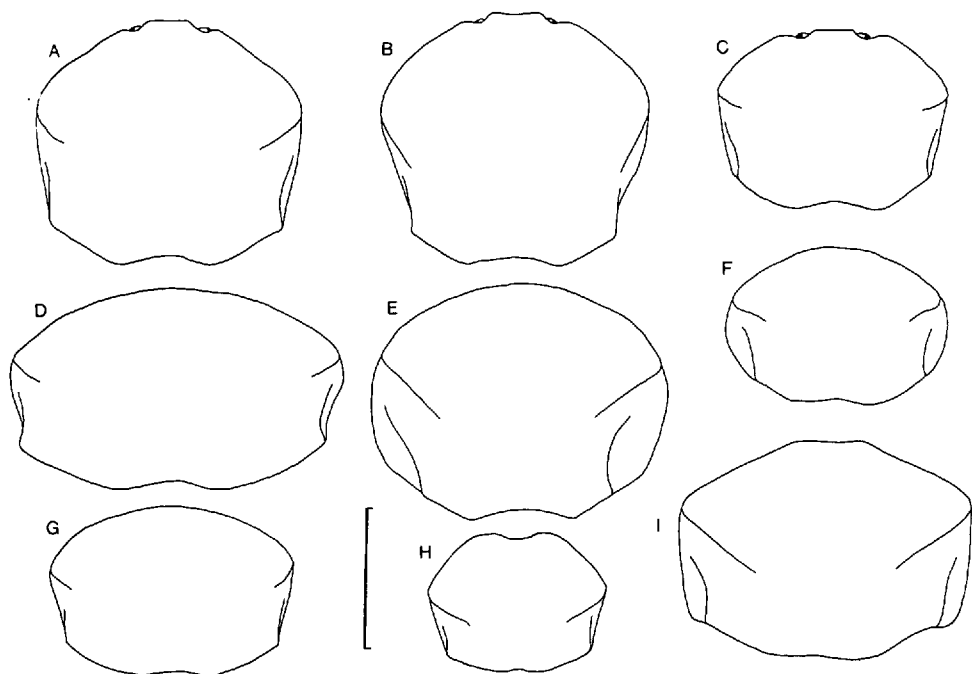


Figure 9. Carapaces of *Dissodactylus* species. A, *D. nitidus*; B, *D. lockingtoni*; C, *D. xantusi*; D, *D. latus*; E, *D. primitivus*; F, *D. schmitti*; G, *D. crinitichelis*; H, *D. glasselli*; I, *D. mellitae*. Scale bar: 1 mm.

Hosts.—*Meoma ventricosa* (Lamarck), *Plagiobrissus grandis* (Gmelin) (Telford, 1978b; 1982).

Remarks.—The findings of Telford (1978b; 1982) represent the only records of any species of *Dissodactylus* on spatangoid hosts.

D. rugatus Bouvier, 1917

D. rugatus Bouvier, 1917: 396 (type locality, Dominique).

D. calmani Rathbun, 1918: 125, pl. 28, figs. 5, 6 text figs. 72, 73a–b (type locality, Grecian Shoals, Hawk Channel, Florida).

Range.—Soldier Key, Biscayne Bay, Florida (Voss and Voss, 1955); Bahia Honda, Florida (Telford, 1982); Grecian Shoals, Hawk Channel, Florida (Rathbun, 1918);

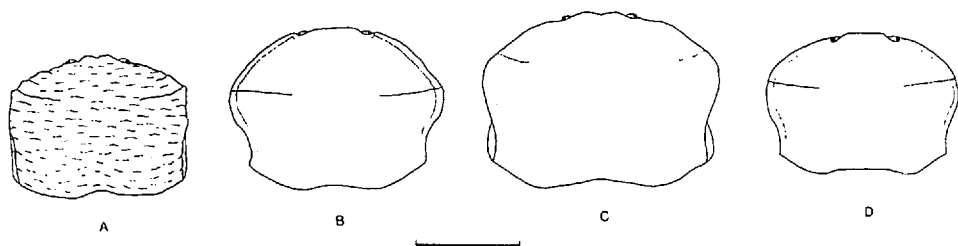


Figure 10. Carapaces of *Dissodactylus* species. A, *D. rugatus*; B, *D. ususfructus*; C, *D. juvenilis*; D, *D. stebbingi*. Scale bar: 1 mm.

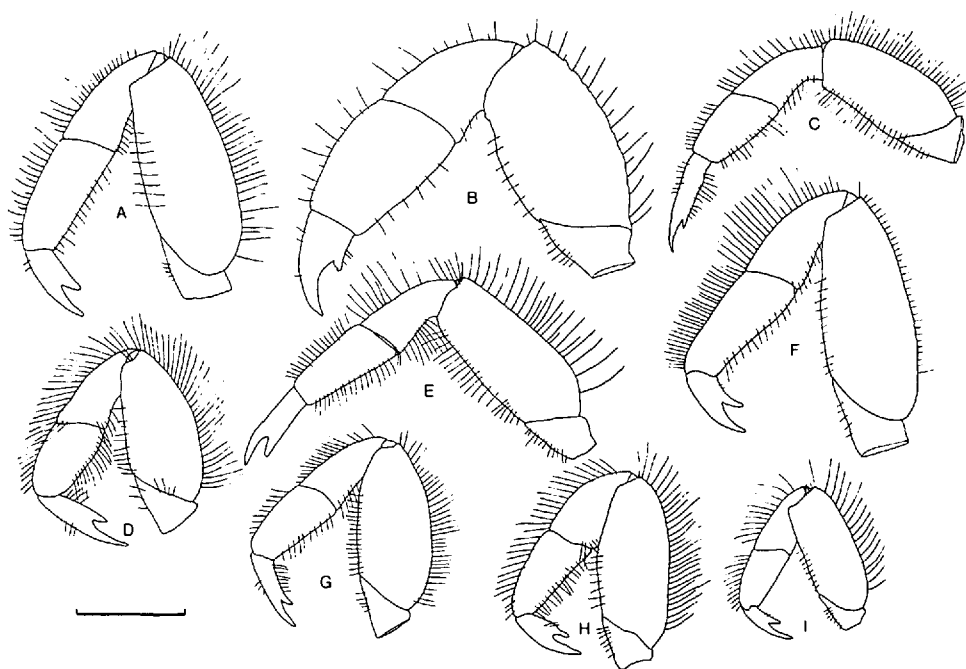


Figure 11. Third ambulatory legs of *Dissodactylus* species. A, *D. nitidus*; B, *D. lockingtoni*; C, *D. primitivus*; D, *D. schmitti*; E, *D. latus*; F, *D. xantusi*; G, *D. crinitichelis*; H, *D. glasselli*; I, *D. mellitae*. Scale bar: 1 mm.

off Duck Key, Hawk Channel, Florida (M. Telford, personal collection); Laveros Italianas, Cayo Laveros, northwest Cuba (Schmitt et al., 1973); Mosquito Island, B.V.I. (Telford, 1982).

Hosts. — *Clypeaster rosaceus* (Linnaeus) (Telford, 1982).

D. stebbingi Rathbun, 1918

D. stebbingi Rathbun, 1918: 123, pl. 28, figs. 1, 2, text fig. 69 (type locality, Sarasota Bay, Florida).

Range. — Sarasota Bay, Florida (Rathbun, 1918); Alligator Harbor, Florida (Schmitt et al., 1973); south of Pigeon Key, Florida (Telford, personal collection).

Hosts. — *Clypeaster subdepressus* (Gray) (Wass, 1955).

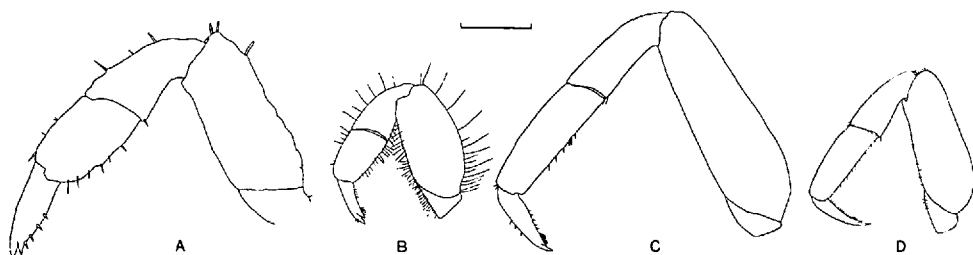


Figure 12. Third ambulatory legs of *Dissodactylus* species. A, *D. rugatus*; B, *D. stebbingi*; C, *D. juvenilis*; D, *D. ususfructus*. Scale bar: 1 mm.

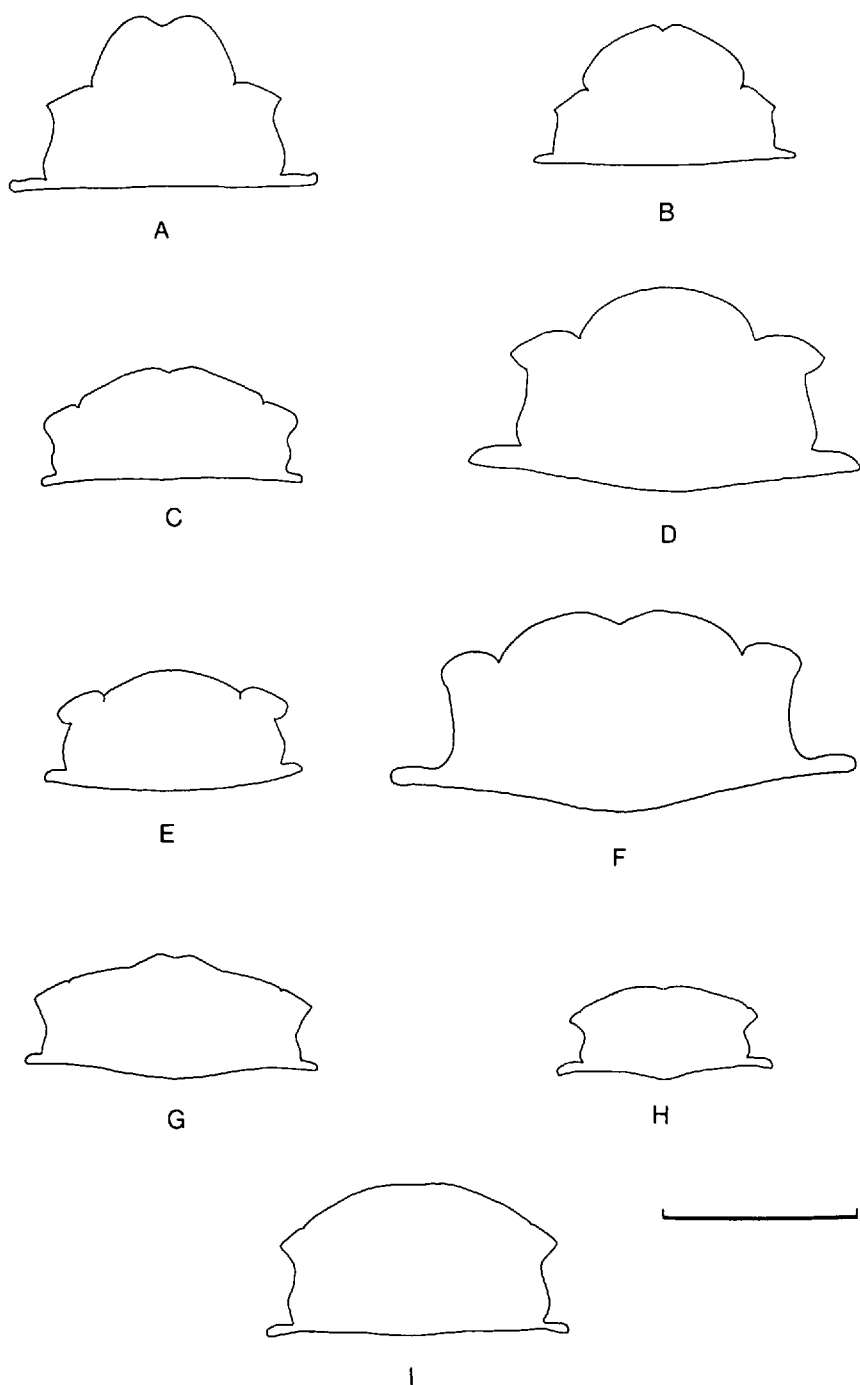


Figure 13. First sternites of *Dissodactylus* species. A, *D. nitidus*; B, *D. lockingtoni*; C, *D. xantusi*; D, *D. primitivus*; E, *D. schmitti*; F, *D. latus*; G, *D. crinitichelis*; H, *D. glasselli*; I, *D. mellitae*. Scale bar: 3 mm.

D. xantusi Glassell, 1936

D. xantusi Glassell, 1936: 299, pl. 21, fig. 4 (type locality, Espiritu Santo Island, Gulf of California, Mexico).

Range.—Espiritu Santo Island, Gulf of California, Mexico (Glassell, 1936); east side of peninsula from San Felipe Bay, Los Animas Bay, Coyote Cove, Concepcion Bay, and on mainland side of Gulf at Punta Peñasco, Sonora, Mexico (Glassell, 1936); Venado Beach, Panama (Dexter, 1977).

Hosts.—*Mellita longifissa* Michelin (Glassell, 1936); three species of *Encope* (MacGinitie and MacGinitie, 1949); *Encope stokesi* (Dexter, 1977).

D. latus new species

Type Locality.—Three miles north of Pigeon Key, Florida.

Range.—Little Torch Key; Pigeon Key, Florida.

Hosts.—*Encope michelini* L. Agassiz, *Leodia sexesperforata* (Leske), *Clypeaster subdepressus* (Gray).

D. schmitti new species

Range.—Type locality only: Five miles north of White Friars, Mexico, 17°31'N, 101°29'W.

Hosts.—Unknown, possibly *Meoma* sp(p), or some other spatangoid(s).

Remarks.—The Spatangoida is suggested as a possible host taxon for *D. schmitti* because of the morphological similarity between this species and the Atlantic *D. primitivus*, which is known only from spatangoids.

D. ususfructus new species

Range.—S-SE Judas Pt., Costa Rica (station data New York Zoological Society "ZACA" Expedition, 1938); 10 miles southwest of Secas Islands, Panama; off Santa Elana Bay, Ecuador (Allan Hancock Pacific Expeditions station data) (Fraser, 1943).

Hosts.—Unknown, possibly *Clypeaster europacificus* H. L. Clark.

KEY TO SPECIES OF *DISSODACTYLUS*

- 1a. Distal region of ischio-merus of outer maxilliped subrectangular, bearing robust palp (Fig. 8A-I); dorsolateral margin of carapace disjunct behind widest point, minute ridge extending obliquely onto carapace surface (Fig. 9A-I); dactyls of first three ambulatory legs bifurcate for at least $\frac{1}{4}$ length (Fig. 11A-I) 5
- 1b. Distal region of ischio-merus of outer maxilliped suboval, bearing minute, narrow palp (Fig. 8J-M); dorsolateral margin of carapace not disjunct behind widest point; slightly oblique, or almost transverse groove intruding onto carapace surface from in lateral margin in front of widest point (Fig. 10A-D); dactyls of first three ambulatory legs bifurcate for less than $\frac{1}{4}$ length (Fig. 12A-D) 2
- 2a. Carapace (Fig. 10A) and legs rugose; dactyls of ambulatory legs with short, stout spines on ventral margins (Fig. 12A) *D. rugatus*
- 2b. Carapace (Fig. 10B-D) and legs smooth and shiny; dactyls of ambulatory legs without short, stout spines (Fig. 12B-D) 3
- 3a. Ambulatory legs broad (merus width to length ratio > 0.45) and setose (Fig. 12B) *D. stebbingi*
- 3b. Ambulatory legs narrow (merus width to length ratio < 0.40) with few setae (Fig. 12C, D) 4

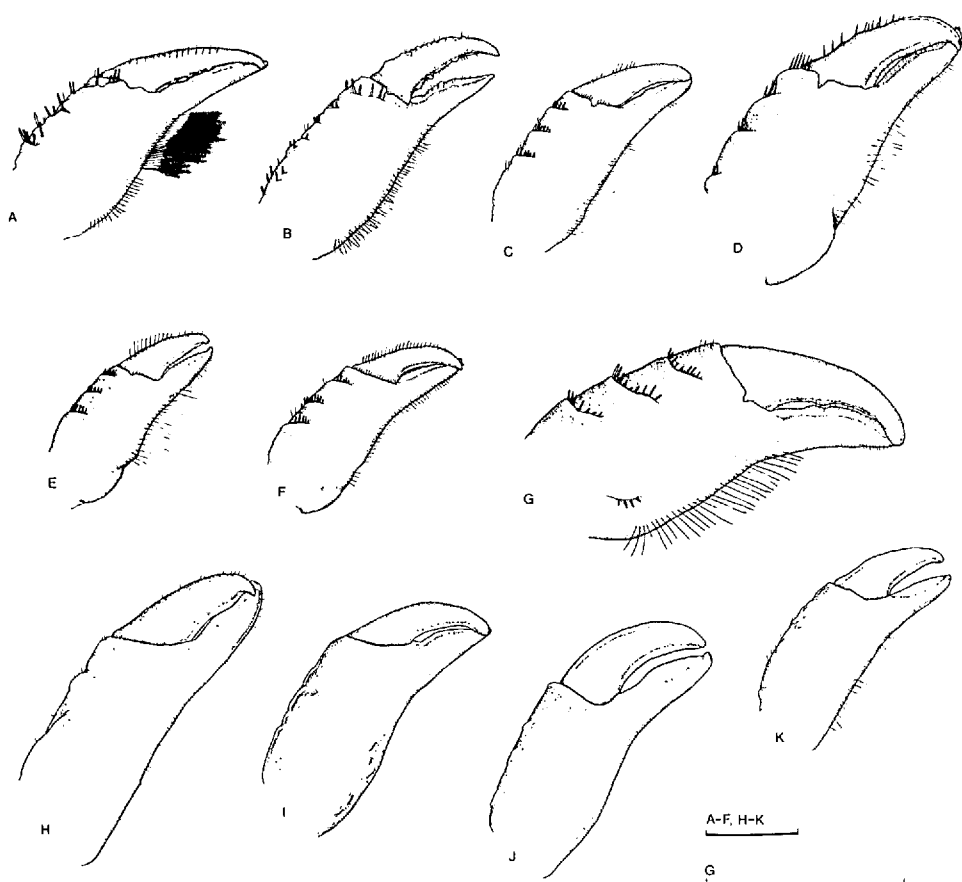


Figure 14. Chelipeds of *Dissodactylus* species. A, *D. nitidus*; B, *D. lockingtoni*; C, *D. xantusi*; D, *D. primitivus*; E, *D. latus*; F, *D. crinitichelis*; G, *D. mellitae*; H, *D. rugatus*; I, *D. ususfructus*; J, *D. juvenilis*; K, *D. stebbingi*. Scale bars: 1 mm.

- 4a. Distinct, almost transverse groove intruding on dorsal surface of carapace from lateral margin; $\frac{1}{2}$ carapace width (Fig. 10B); front straight, or slightly convex *D. ususfructus*
- 4b. Groove intruding on dorsal carapace surface short, oblique, inconspicuous in adults; front shallowly bilobed (Fig. 10C) *D. juvenilis*
- 5a. Middle region of first sternal segment tongue-like, extended beneath buccal region (Fig. 13A, B); cheliped fingers slender, long, tapered, with several granular teeth (Fig. 14A, B); carapace width to length ratio less than 1.2 (Fig. 9A, B) 6
- 5b. First sternal segment broad, medial extension not tongue-like (Fig. 13C-I); cheliped fingers stout, dorsal and ventral margins convergent gradually for proximal $\frac{2}{3}$, then abruptly at the tip, a few low-crowned teeth (Fig. 14C-G); carapace width to length ratio greater than 1.2 (Fig. 9C-I) 7
- 6a. Carapace smooth and shiny; ambulatory legs long and slender (Fig. 11A); cheliped with dense tuft of setae on ventral margin of propodus (Fig. 14A); ischio-merus of outer maxilliped squared distally, palp robust, with squared segments (Fig. 8A); dactyl of maxilliped palp vestigial, microscopic *D. nitidus*
- 6b. Carapace covered with minute granules, not shiny; ambulatory legs stout (Fig. 11B); propodus of cheliped without dense tuft of setae (Fig. 14B); ischio-merus of outer maxilliped rounded, palp segments rounded, dactyl small but distinct (Fig. 8B) *D. lockingtoni*
- 7a. First sternal segment with distinct lateral notch (Fig. 13C-F) 8
- 7b. First sternal segment with minute notches, or no notches (Fig. 13G-I) 11

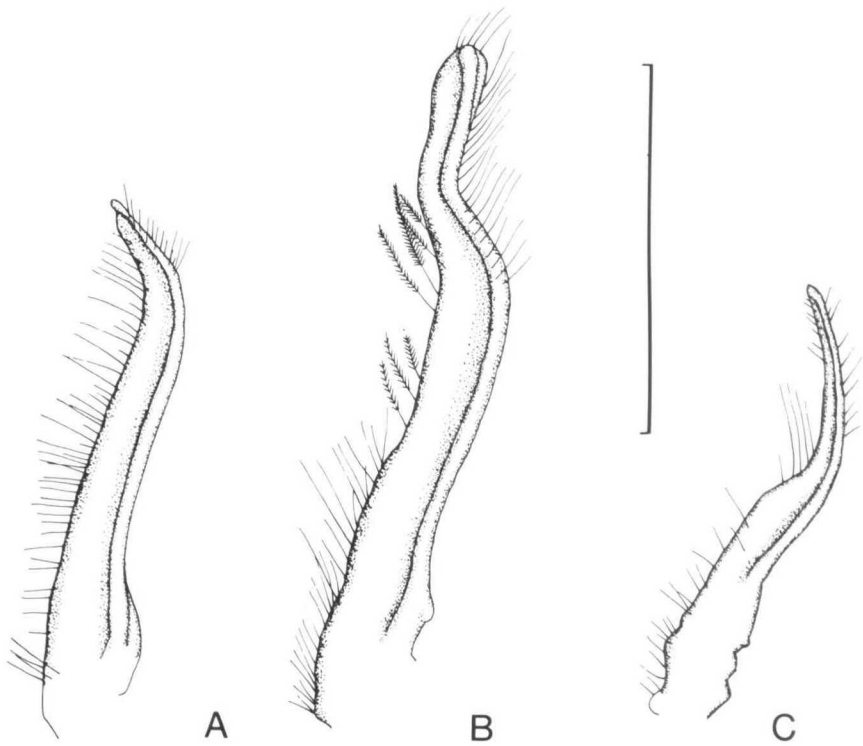


Figure 15. Gonopods of A, *D. crinitichelis*; B, *D. glasselli*; C, *D. mellitae*. Scale bar: 1 mm.

- 8a. Carapace approaching pentagonal; eyes large, about the size of the propodus (second palpal segment) of the outer maxilliped, protruding from beneath front (Fig. 9C) *D. xantusi*
- 8b. Carapace with rounded anterior margin; eyes very small, much smaller than propodus of outer maxilliped, hidden beneath front 9
- 9a. Carapace broad, width to length ratio greater than 1.55 (Fig. 9D) *D. latus*
- 9b. Carapace width to length ratio between 1.3 and 1.4 10
- 10a. Dactyls of ambulatory legs bifurcate less than 1/3 length (Fig. 11C); lateral lobes of first sternite distolaterally pointed (Fig. 13D) *D. primitivus*
- 10b. Dactyls of ambulatory legs bifurcate between 1/3 and 1/2 length (Fig. 11D); lateral lobes of first sternite distolaterally rounded (Fig. 13E) *D. schmitti*
- 11a. Palp of outer maxilliped with three segments (Fig. 8G); ridge from anterolateral angle continuing obliquely onto carapace for about 1/4 of carapace width (Fig. 9G); male gonopod with short tip (Fig. 15A); all female abdominal segments free *D. crinitichelis*
- 11b. Palp of outer maxilliped with two segments (dactyl absent) (Fig. 8H, I); ridge from anterolateral margin continuing obliquely onto carapace surface for about half carapace width (Fig. 9H, I); tip of male gonopod elongate (Fig. 15B, C); second to fourth segments of female abdomen fused 12
- 12a. Front concave or recessed (Fig. 9H); tip of male gonopod curving inward, then outward, ending in blunt tip (Fig. 15B) *D. glasselli*
- 12b. Front slightly convex or straight across (Fig. 9I); tip of male gonopod curving outward, gradually tapering to a point (Fig. 15C) *D. mellitae*

ACKNOWLEDGMENTS

I am grateful to my supervisor, Professor M. Telford, Department of Zoology, University of Toronto, for his advice and support. Thanks to Dr. J. Haig, Allan Hancock Foundation; Dr. H. Levi, Museum of Comparative Zoology; Dr. R. Manning, United States National Museums and Dr. M. Türkay,

Senckenberg Naturmuseum und Forschungsinstitut, Frankfurt a. Main for loans of types and other specimens. Many crabs were obtained as serendipitous results of the sand dollar collecting activities of Dr. Telford, Tony Harold, Rich Mooi and Olaf Ellers. A specimen of *D. primitivus* from Panama was provided by Dr. H. Lessios, Smithsonian Tropical Research Institute, Panama. Helpful comments on various drafts and portions of the manuscript were made by Dr. Telford, Rich Mooi, Randy Mooi, Dr. D. Calder, Royal Ontario Museum and Dr. R. Winterbottom, Royal Ontario Museum. Research funds were supplied by National Sciences and Engineering Research Council of Canada Operating Grant no. A4696 (to M. Telford). Personal financial support was provided by an Ontario Graduate Scholarship and a University of Toronto Open Fellowship.

LITERATURE CITED

- Agassiz, A. 1878. Reports of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico, by the United States Coastal Survey Steamer "Blake," Lieutenant-Commander C. D. Sigsbee, U.S.N. commanding. Bull. Mus. Comp. Zool. 5: 183-195.
- Bell, J. L. 1984. Changing residence: dynamics of the symbiotic relationship between *Dissodactylus mellitae* Rathbun (Pinnotheridae) and *Mellita quinquesperforata* (Leske) (Echinodermata). J. Exp. Mar. Biol. Ecol. 82: 101-115.
- and S. E. Stancyk. 1983. Population dynamics and reproduction of *Dissodactylus mellitae* (Brachyura: Pinnotheridae) on its sand dollar host *Mellita quinquesperforata* (Echinodermata). Mar. Ecol. Progr. Ser. 13: 141-149.
- Bott, R. 1955. Dekapoden aus El Salvador. Senckenbergiana Biologica 36: 45-72.
- Bouvier, M. E.-L. 1917. Gonoplacides et Pinnotherides nouveaux recueillis au cours des campagnes américaines du "Hassler" et du "Blake." Bull. Mus. Nat. Hist. Nat. Paris 23: 391-398.
- Clark, H. L. 1940. Eastern Pacific Expeditions of the New York Zoological Society. XXI. Notes on the echinoderms from the west coast of Central America. Zoologica 25: 331-352.
- . 1948. A report on the Echini of the warmer Eastern Pacific, based on the collections of "Velero III." Allan Hancock Foundation Pacific Expeditions 8: 225-360.
- Dexter, D. M. 1977. A natural history of the sand dollar *Encope stokesi* L. Agassiz in Panama. Bull. Mar. Sci. 27: 544-551.
- Fraser, C. M. 1943. General account of the scientific work of the "Velero III" in the Eastern Pacific, 1931-41. Part III. A ten-year list of the "Velero III" collecting stations (Charts 1-115). Allan Hancock Pacific Expeditions 1: 259-431.
- Glassell, S. A. 1934. Affinities of the brachyuran fauna of the Gulf of California. J. Wash. Acad. Sci. 24: 296-302.
- . 1935. New or little known crabs from the Pacific coast of northern Mexico. Trans. San Diego Soc. Nat. Hist. 8: 91-106.
- . 1936. New porcellanids and pinnotherids from tropical North American waters. Trans. San Diego Soc. Nat. Hist. 8: 277-304.
- Lemaître, R. 1984. Decapod crustaceans from Cay Sal Bank, Bahamas, with notes on their zoogeographic affinities. J. Crust. Biol. 4: 425-447.
- Lockington, W. N. 1877. Results on the Crustacea of the west coast of North America, with a catalogue of species in the museum of the California Academy of Sciences. Proc. Calif. Acad. Sci. 7: 145-156.
- MacGinitie, G. H. and N. MacGinitie. 1949. Natural history of marine animals. McGraw-Hill, New York. 473 pp.
- Milne-Edwards, A. and M. E.-L. Bouvier. 1923. Reports of the results of dredging, etc. XLVII: Les porcellanides et les brachyours. Mem. Mus. Comp. Zool. 47: 281-396.
- Moreira, C. 1901. Crustaceos do Brazil. Arch. Mus. Nat. Rio de Janeiro 11: 1-160.
- Pearse, A. J. 1936. Estuarine animals at Beaufort, North Carolina. J. Elisha Mitchell Soc. 52: 174-222.
- , H. J. Humm and G. W. Wharton. 1942. Ecology of sand beaches at Beaufort, North Carolina. Ecol. Monogr. 12: 136-190.
- Pohle, G. 1984. Larval development of *Dissodactylus rugatus* Bouvier, 1917 (= *D. calmani* Rathbun, 1918) (Brachyura: Pinnotheridae) reared under laboratory conditions. J. Crust. Biol. 4: 572-588.
- Rathbun, M. J. 1898. The Brachyura collected by the U.S. Fish Commission steamer "Albatross" on the voyage from Norfolk, Virginia, to San Francisco, California, 1887-1888. Proc. U.S. Nat. Mus. 21: 567-616.
- . 1900. Synopsis of North American invertebrates. VII. The catometopous or grapsoid crabs of North America. Amer. Nat. 34: 583-582.
- . 1901. The Brachyura and Macrura of Porto Rico. U.S. Fish Wildl. Serv. Fish. Bull. 20: 1-127.

- . 1910. Stalk-eyed Crustacea of Peru and the adjacent coast. *Proc. U.S. Nat. Mus.* 38: 531–620.
- . 1918. The grapsoid crabs of America. *Bull. U.S. Nat. Mus.* 97: 1–461.
- . 1923. The crabs collected by the U.S. Fisheries steamer "Albatross" in 1911, chiefly on the west coast of Mexico. *Bull. Amer. Mus. Nat. Hist.* 48: 619–637.
- . 1933. Brachyuran crabs of Porto Rico and the Virgin Islands. *Scientific Survey of Porto Rico and the Virgin Islands, New York Acad. Sci.* 15: 1–121.
- Rathbun, R. 1885. Report on the Echini collected by the U.S. Fisheries steamer "Albatross" in the Gulf of Mexico from January to March, 1885. *Proc. U.S. Nat. Mus.* 8: 606–620.
- Rioja, E. 1944. Estudios carcinológicos XVI. Observaciones sobre algunas especies de cangrejos del genero *Dissodactylus* Smith (Braquios, Pinnoteridos) de las costas Mexicanas del Pacifico. *An. Inst. Biol. Mexico* 15: 147–160.
- Rogers, B. 1968. An extension of the range of the pinnotherid crab *Dissodactylus mellitae* (Rathbun). *Crustaceana* 14: 318.
- Schmitt, W. L., J. C. McCain and E. S. Davidson. 1973. H.-E. Gruner and L. B. Holthuis, eds. *Crustaceorum Catalogus. III. Decapoda I. Brachyura I. Family Pinnotheridae*. Dr. W. Junk B.V.-Den Haag. 160 pp.
- Smith, S. I. 1870. Notes on American Crustacea. No. 1. Ocypodoidea. *Trans. Conn. Acad. Arts Sci.* 2: 113–176.
- Steinbeck, J. and E. F. Ricketts. 1941. *Sea of Cortez. A leisurely journal of travel and research*. Viking Press, New York. 598 pp.
- Sumner, F. B. 1909. The Biological Laboratory of the Bureau of Fisheries at Woods Hole, Mass. Report of the past year's work, and announcements for the coming season. *Science, N.Y.* (n. ser.) 29(756): 983–987.
- Telford, M. 1978a. Post-larval growth of two species of *Dissodactylus* (Brachyura: Pinnotheridae). *Bull. Mar. Sci.* 28: 645–650.
- . 1978b. Distribution of two species of *Dissodactylus* (Brachyura: Pinnotheridae) among their echinoid host populations in Barbados. *Bull. Mar. Sci.* 28: 651–658.
- . 1982. Echinoderm spine structure, feeding and host relationships of four species of *Dissodactylus* (Brachyura: Pinnotheridae). *Bull. Mar. Sci.* 32: 584–594.
- Voss, G. L. and N. Voss. 1955. An ecological survey of Soldier Key, Biscayne Bay, Florida. *Bull. Mar. Sci.* 5: 203–229.
- Wass, M. L. 1955. The decapod crustaceans of Alligator Harbor and the adjacent inshore areas of northwestern Florida. *Quart. J. Fla. Acad. Sci.* 18: 129–176.
- Williams, A. B., I. R. McCloskey and I. E. Gray. 1968. New records of brachyuran decapod crustaceans from the continental shelf off North Carolina, U.S.A. *Crustaceana* 15: 41–66.

DATE ACCEPTED: July 8, 1986.

ADDRESS: Department of Zoology, University of Toronto, Toronto, Ontario M5S 1A1, Canada.